



U.S. Department  
of Transportation

Research and  
Special Programs  
Administration

JUN 23 2000

400 Seventh Street, S.W.  
Washington, D.C. 20590

DOT-E 11526  
(SIXTH REVISION)

EXPIRATION DATE: May 31, 2002

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: BOC Gases (BOC)  
Murray Hill, NJ
2. PURPOSE AND LIMITATION:
  - a. This exemption authorizes the transportation in commerce of certain DOT Specification 3A or 3AA cylinders for the transportation in commerce of the compressed gases described in paragraph 6 below. The DOT Specification 3A or 3AA cylinders are retested by 100% ultrasonic inspection in lieu of the internal visual inspection and hydrostatic retest required in § 173.34(e). This exemption provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein.
  - b. The safety analyses performed in development of this exemption only considered the hazards and risks associated with transportation in commerce.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR § 173.34 (e)(1), (e)(3), (e)(4), (e)(8), (e)(13), (e)(16)(i)(D), and § 173.302(c)(2), (3), (4), and (5) in that the ultrasonic inspection is performed in lieu of the specified internal visual examination and hydrostatic pressure test.
5. BASIS: This exemption is based on the application of BOC Gases dated April 18, 2000, submitted in accordance with § 107.109.

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6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Proper Shipping Name/ Hazardous Materials Description	Hazard Class/ Division	Identi- fication Number	Packing Group
Liquefied or non-liquefied compressed gases, or mixtures of such compressed gases, classed as Division 2.1, (flammable gas) Division 2.2, (nonflammable gas) or Division 2.3, (gases which are Toxic by Inhalation (TIH)) which are authorized in the Hazardous Materials Regulations for transportation in DOT 3A and 3AA cylinders.	As appropriate.	As appropriate.	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packaging prescribed is a DOT Specification 3A or 3AA cylinder that is subjected to periodic retesting, reinspection and marking prescribed in § 173.34(e), except that the cylinder is examined by ultrasonic inspection in lieu of the hydrostatic pressure test and internal visual examination prescribed in § 173.34(e)(1). Each cylinder must be subjected to an external visual examination and retested in accordance with the procedure described in BOC's application for exemption on file with the Office of Hazardous Materials Exemption and Approvals (OHMEA) unless otherwise noted herein.

b. Ultrasonic equipment - The ultrasonic test equipment used in accordance with the test procedure shall be of a pulse echo type and incorporate multiple focused array transducers to perform both angle beam and straight beam inspection so that 100 percent volumetric examination of the cylinder sidewall and sidewall to base transition (SBT) is accomplished. The equipment shall incorporate continuous automatic monitoring of the transducer to cylinder wall acoustic coupling. It must be possible to discern and abort the test when the ultrasonic data indicates a loss of acoustic coupling between the transducer assembly and the cylinder wall.

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This safety control measure should be an integral part of the test equipment design incorporating Lack-of-Expected-Response (L.E.R.) monitoring independent of operator actions.

c. Equipment Performance and Test Procedure - The ultrasonic equipment performance and test procedure and rejection criteria must conform to Appendix A, B, and C of BOC's application except as modified or specifically stated herein:

(1) BOC APPENDIX A.

(a) Paragraph 8.

When ultrasonic inspection of 200 cylinders has been completed, or a time period of more than 4 hours has elapsed since the equipment calibration, whichever occurs first, the equipment must be calibrated again in accordance with the requirements in APPENDIX C.

(b) Paragraph 8.

If the manufacturer's design minimum wall thickness is not available for a cylinder under test, the design minimum wall thickness suggested in the Compressed Gas Association Pamphlet C-6, "Standards for Visual Inspection of Compressed Gas Cylinders" must be used.

(c) Paragraph 9. Assessment of results:

Any cylinder that is shown to be of less than the design minimum wall thickness or has internal defects affecting the cylinder's suitability for continued service must be deemed to have failed the DOT retest and requalification requirements.

Any cylinder found with the following defects must be rejected:

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(i) In any area larger than 0.7 in<sup>2</sup> (0.5" by 1.4"), the maximum wall stress calculated from the following formula exceeds 58,000 psi for DOT-3A or 73,000 psi for DOT-3AA specification cylinders:

$$S = P(1.3D^2 + 0.4d^2)/(D^2 - d^2)$$

where:

S = wall stress in pounds per square inch;

P = minimum test pressure in pounds per square inch;

D = outside diameter in inches;

d = D-2t, where t=minimum wall thickness determined by ultrasonic testing, in inches.

(ii) In any area larger than 0.06 in<sup>2</sup> (0.5" by 0.12"), the maximum wall stress calculated from the above formula exceeds 64,000 psi for DOT-3A or 81,000 psi for DOT-3AA specification cylinders.

(iii) An isolated pit that is deeper than 1/3 of the design minimum wall thickness ( $t_{min}$ ) and larger than 1/8-inch diameter for cylinders equal or less than 4-inches in outside diameter.

(iv) An isolated pit that is deeper than 1/3 of the design minimum wall thickness ( $t_{min}$ ) and larger than 1/4-inch diameter for cylinders larger than 4-inches in outside diameter.

(v) A SBT defect that is deeper than 1/5 of the design wall thickness ( $t_{min}$ ) and longer than 1-inch in length.

(2) BOC APPENDIX B.

(a) Detection Requirements:

(i) For wall thickness measurements, the system must be capable of detecting a minimum wall area of 0.70 square inch in area with a thickness of  $t_{min}$  using a straight beam focused transducer.

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(ii) For isolated pits, the system must be capable of detecting a flat bottom hole 1/8-inch diameter by  $1/3 t_{\min}$  for cylinders equal or less than 4 inches in inside diameter and 1/4-inch diameter by  $1/3 t_{\min}$  for cylinders larger than 4 inches in inside diameter.

(iii) For SBT defects, the system must be capable of detecting a notch 1-inch long by  $1/10 t_{\min}$  in inside diameter.

(3) BOC APPENDIX C.

(a) C.6. Procedures for Calibration Setup:

The equipment calibration and set up for inspection shall be such that a reject signal is produced and recorded when the indicated thickness at any location on the calibration cylinder is less than the minimum design wall thickness. The areas rejected by the system must correspond to all known calibrated defects and minimum wall thickness area used during the system calibration and the corresponding calibration cylinder. No testing may be performed unless the system is properly calibrated.

(b) C.7. Calibration Cylinder Specifications

A cylinder used as a calibration standard shall be of the same nominal diameter, surface finish, metallurgical type as the cylinders to be tested i.e., DOT 3A for 3A cylinders and DOT 3AA for the 3AA type cylinders. Prior to machining for calibration defects and the minimum wall thickness, the minimum wall thickness for the calibration cylinder shall be determined by means of an independent method. The calibration cylinder shall be machined with defects simulating those that cause reduction in wall thickness due to service conditions. The remaining wall shall conform to the design minimum wall thickness for the cylinder under test. For the purpose of testing under this exemption, BOC will have a calibration cylinder which represents each specification, service pressure, and diameter of cylinder being tested. A certification statement signed by a person certified as a NDT Level III in ultrasonic testing must be available for inspection for each calibrated cylinder.

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d. Personnel Qualification - Each person who performs retesting, and evaluates and certifies retest results must meet the following qualification requirements:

(1) The personnel responsible for performing cylinder retesting per this exemption shall be qualified to an appropriate Level (Level I, II or III)- Ultrasonic Testing in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A depending upon the assigned responsibility as described below:

(a) As a minimum, certification is required by a Level II. The Level II Operator must perform system startup, calibrate the system, and review and certify the test results when a written acceptance and rejection criteria for cylinders has been provided by a Senior Review Technologist. Based upon the written criteria, the Level II Operator may authorize cylinders that pass the retest to be marked in accordance with paragraph 7.g. of this exemption. However, a person with Level I certification may perform a system startup, check calibration, and perform ultrasonic testing under the direct guidance and supervision of a Senior Review Technologist or a Level II Operator, either of whom must be physically present at the test site so as to be able to observe testing conducted under this exemption.

(b) Senior Review Technologist (SRT) - is a person who reviews overall test results, provides supervisory training and technical guidance to Operators, and reviews and verifies the retest result. A SRT must have a Level III Certification in UT, and a thorough understanding of the DOT Regulations pertaining to the re-qualification and reuse of the DOT cylinders authorized under this exemption. The SRT must prepare and submit the reports required in paragraphs 8.a. and 8.b. and annually verify that the UT program is being operated in accordance with the requirements of this exemption.

(2) Project Manager - Senior Manager and Officer of BOC, responsible for compliance with the DOT regulations including this exemption.

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e. Test Procedure: The retest procedure and acceptance criteria must conform to the following:

(1) A written document describing the test set-up and test parameters; transducer model number, frequency, and size, transducer assembly, couplant used, system calibration method and threshold gain used in the test; and other pertinent information such as additional gain during the test period used to confirm the defects shall be on file at the test site, and must be made available to a DOT official when requested. Any change from the written test procedure must be submitted to OHMEA as soon as practicable.

(2) Any cylinder must be rejected if:

(a) In any area larger than 0.7 in<sup>2</sup> (0.5" by 1.4") the maximum wall stress calculated from the following formula exceeds 58,000 psi for DOT-3A or 73,000 psi for DOT-3AA specification cylinders.

$$S = P(1.3D^2 + 0.4d^2) / (D^2 - d^2)$$

where:

S = wall stress in pounds per square inch;

P = minimum test pressure in pounds per square inch;

D = outside diameter in inches;

d = D-2t, where t=minimum wall thickness determined by ultrasonic testing, in inches.

(b) In any area larger than 0.06 in<sup>2</sup> (0.5" by 0.12") the maximum wall stress calculated from the above formula exceeds 64,000 psi for DOT-3A or 81,000 psi for DOT-3AA specification cylinders.

(c) An isolated pit that is deeper than 1/3 of the design minimum wall thickness ( $t_{min}$ ) and larger than 1/8-inch diameter for cylinders equal or less than 4-inches in outside diameter.

(d) An isolated pit that is deeper than 1/3 of the design minimum wall thickness ( $t_{min}$ ) and larger than 1/4-inch diameter for cylinders larger than 4-inches in outside diameter.

(3) If the equipment is found to be out of calibration by the calibration checks carried out after an inspection run (see appendix C.4.9 of the exemption application), all cylinders tested during that

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inspection run must be tested. Secondary retesting under other circumstances is not authorized.

f. Rejected cylinders. When a cylinder is rejected, the retester must stamp a series of X's over the DOT specification number and marked service pressure, or stamp "CONDEMNED" on the shoulder, top head, or neck using a steel stamp, and must notify the cylinder owner, in writing, that the cylinder is rejected and may not be filled with hazardous material for transportation in commerce.

(1) Alternatively, at the direction of the owner, the retester may render the cylinder incapable of holding pressure.

(2) If a condemned cylinder contains hazardous materials and the testing facility does not have the capability of safely removing the hazardous material, the retester must stamp the cylinder "CONDEMNED" and affix conspicuous labels on the cylinder(s) stating: "UT REJECTED DOT E-11526. RETURNING TO ORIGIN FOR PROPER DISPOSITION". The retester may only offer the condemned cylinders by motor vehicle operated by a private carrier to a facility, identified in BOC's August 18, 1999 letter on file with the OHMEA; that is capable of safely removing the hazardous material. A current copy of this exemption must accompany each shipment of condemned cylinders transported for the disposal of hazardous material.

g. Marking. Each cylinder passing retest under the provisions of this exemption must be marked as prescribed in § 173.34(e)(6). In addition, each cylinder must be marked UT, in characters not less than 1/4-inch high at a location close to the retester's marking.

h. Cylinders that have been exposed to fire or to excessive heat (temperatures of 1000°F or greater) must not be retested under the terms of this exemption.

8. SPECIAL PROVISIONS:

a. The total number of cylinders tested under this exemption must be reported by type (i.e. 3A, 3AA) and age. The number of cylinders rejected and the total number of cylinders tested under the provision of this exemption shall be reported by cylinder type and age. These results must be summarized and reported to DOT on a semi-annual basis. For any rejected cylinder, the defect causing the rejection must be fully characterized and profiled. That is, the specific



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type of defect should be identified (i.e. pit, general corrosion, etc.) and the specific size of the defect should be determined (i.e. length, depth, width, area, etc.). The cylinder type, size, minimum design wall thickness, age, etc. of the rejected cylinder must be reported to DOT on an annual basis. BOC must submit to DOT an evaluation of the effectiveness of the ultrasonic testing program authorized by this exemption as part of any request to renew the exemption submitted in accordance with § 107.109.

b. A cylinder that meets the requirements of this exemption and the introductory text and paragraph (1) of § 173.302(c) may be marked with a plus sign (+) following the test date marking on the cylinder. In addition, a cylinder that meets the requirements of this exemption and of § 173.34(e)(16) may be marked with a "star".

c. A person who is not a holder of this exemption who receives a package covered by this exemption may reoffer it for transportation provided no modifications or changes are made to the package and it is reoffered for transportation in conformance with this exemption and the HMR.

d. No person may perform inspection and testing of cylinders subject to this exemption unless that person (1) is an employee or agent of BOC and has a current copy of this exemption at the location of such inspection and testing (2) complies with all the terms and conditions of this exemption. The marking of the retester's symbol on the cylinders certifies compliance with all of the terms and conditions of this exemption, and (3) is an approved DOT independent inspection agency that is an ASNT-TC-1A qualified level III ultrasonic tester.

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, cargo aircraft only, and passenger-carrying aircraft.
10. MODAL REQUIREMENTS: A current copy of this exemption must be carried aboard each aircraft used to transport packages covered by this exemption. The shipper must furnish a copy of this exemption to the air carrier before or at the time the shipment is tendered.
11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this exemption and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:

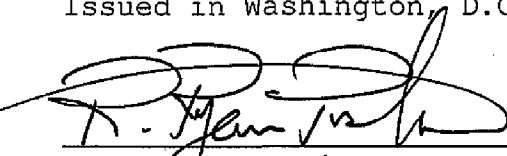
- o All terms and conditions prescribed in this exemption and the Hazardous Materials Regulations, 49 CFR Parts 171-180.
- o Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this exemption must receive training on the requirements and conditions of this exemption in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this exemption, including display of its number, when this exemption has expired or is otherwise no longer in effect.

12. REPORTING REQUIREMENTS: The carrier is required to report any incident involving loss of packaging contents or packaging failure to the Associate Administrator for Hazardous Materials Safety (AAHMS) as soon as practicable. (Sections 171.15 and 171.16 apply to any activity undertaken under the authority of this exemption.) In addition, the holder(s) of this exemption must inform the AAHMS, in writing, of any incident involving the package and shipments made under the terms of this exemption.

Issued in Washington, D.C.:

  
for Robert A. McGuire  
Acting Associate Administrator for  
Hazardous Materials Safety

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(DATE)

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Research and Special Programs Administration, Department of Transportation, Washington, D.C. 20590.  
Attention: DHM-31.

The original of this exemption is on file at the above office. Photo reproductions and legible reductions of this exemption are permitted. Any alteration of this exemption is prohibited.

Copies of exemptions may be obtained from the AAHMS, U.S. Department of Transportation, 400 7th Street, S.W., Washington, DC 20590-0001, Attention: Records Center, 202-366-5046.

PO: KFW